

# NASA TECH BRIEF



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## Inhibition of Browning in Foodstuffs

### The problem:

During the preparation or subsequent storage of food, a chemical phenomenon of nonenzymatic browning or so-called "Maillard Reaction" takes place. While acceptable in some instances, as in bread crusts, maple syrup, and coffee, in many instances, this browning results in products that are "off flavor", "off odor", and "off color" and suffer reduced nutritional value. Typical are desiccated egg, spray dried milk powder, dehydrated fruits, fruit juice concentrates, and starch and protein hydrolyzates. Previous attempts to inhibit this browning by refrigeration, chemical additives, or the enzymatic removal of sugar have proven ineffective in most instances.

### The solution:

It has been found that the addition to a mixture of carbohydrates, and either proteins, peptides, or amino acids of water-soluble sulfur-containing compounds of two general types (sometimes referred to as "anti-browning agents"), i.e., thio compounds or potential thio compounds, can retard or completely eliminate the browning process. The determining factor between inhibition and elimination is solely dependent upon the concentration of the anti-browning agent present in the aqueous media.

These anti-browning agents are able to inhibit or eliminate the physical appearance of browning or darkening in solid mixtures, in gels, or in solutions of carbohydrates, particularly in reducing sugars of the aldose type in the presence of proteins, peptides, or amino acids, such as are found in fish, meat, cereal, vegetable, and other processed foods, alone or in combination, following storage at ambient or even at somewhat elevated temperatures, such as those of approximately 55°C. Such anti-browning agents all contain sulfur and are largely restricted to those

water-soluble compounds which are derived or capable of being derived from naturally occurring materials which themselves are foods. For use in food products, liquid diets, and the like, the anti-browning agents must be physiologically acceptable materials.

The water-soluble, sulfur-containing, anti-browning agents contemplated are of two general types, i.e., thio compounds or potential thio compounds. The thio compounds include glutathione (reduced), homocysteine, N-acetyl homocysteine •HCl, cysteine, cysteine ethyl ester hydrochloride, and N-acetyl cysteine •HCl. Potential thio compounds include homocysteine thiolactone and thiazolidine-4-carboxylic acid, and those sulfur-containing compounds which in hydrolysis with water, are capable of yielding thio compounds.

### Note:

No further documentation is available. Technical inquiries may be directed to:

Technology Utilization Officer  
Headquarters  
National Aeronautics  
and Space Administration  
Washington, D.C. 20546  
Reference: B69-10493

### Patent status:

Title to this invention has been waived under the provisions of the National Aeronautics and Space Act [42 U.S.C. 2457 (f)], to Schwarz Bioresearch, Inc., Mountain View Avenue, Orangeburg, New York.

Source: Norman A. Rosenthal of  
Schwarz Bioresearch, Inc.  
under contract to  
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